View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Marina Chimica Acta

Marina Chimica Acta
The University of Hasanuddin
Volume 18 No. 1, 2017

MINERAL ANALYSIS (CU, PB AND CD) AND BIO-PHYSICAL CHEMISTRY TEST HONEY ORIGIN DISTRICT. KINDANG BULUKUMBA

Rabiatul Adawiah, Alfian Noor, Maming

Radiation Chemistry Laboratory
Department of Chemistry, Faculty of Science, University of Hasanuddin
Campus Tamalanrea Km 10
**Corresponding author*: *rabiatuladawiah08@gmail.com*

ABSTRACT

Honey is a natural product produced by bees that contain nutrients that are very essential. Honey is not only a material sweeteners, flavoring or food, but is also used for drugs. This research aims to know the quality of honey Kindang Bulukumba Subdistrict origin. Mineral content in honey is one of the factors determining the quality of honey, for the analysis of minerals (copper, lead and cadmium) and test of bio-chemical physics with ICP-OES instruments. The concentration of minerals copper, was 0, 024mg/L, while the lead and cadmium was not detected by the value parameter test bio-chemical physics is honey; the grey levels of 0.26%; moisture content 19,69%; DHL 0, 41mS/cm; the acidity of 22, 06meq/kg; pH 4.43; 7.19% protein; fat 0,1301%; 77,55% carbohydrates. The results showed that the original honey Kindang has a quality in accordance with the National standard of Indonesia and the International Honey Commission.

Keywords: *Bio-Phisic chemical, Honey, Kindang, Mineral.*

1. INTRODUCTION

Since thousands of years ago until now, honey has been known as one of the ingredients of natural food or drink which has an important role in the life and health. Honey is a natural product produced by bees that contain nutrients that are very essential. Honey is not only a material sweeteners, flavoring or food, but is also used for drugs. Honey can be used to get rid of tired and weary, and can also be used to smooth the skin, and hair growth ([8] [7]).

In honey contain some essential and non essential minerals, minerals that are categorized as essential is a mineral that is needed in the physiological processes of living things, such as Ba, Sr, Bi, Sn, W, Sb, Cr, V, Mo, P, S, Ca, Mg, K, Na, Zn, Fe, Cu, and Mn. non essential Minerals until recently unknown benefits in the body of any living being, even when the body is found in high concentrations can damage organs, including Cd , Hg, Pb and Al [6].

According to [3], the minerals contained in honey greatly influences the quality of honey. The difference in the concentrations of *trace elements* and minerals in honey is affected by factors of botanical and geographical origin of the honey, and according to [9], the absorption of minerals is influenced by the composition of the soil where the nectar sources are located. Honey quality also is affected by several factors, namely bio-chemical physics testing moisture content, ash, protein, karboh idrat, fat acidity, pH, and conductivity of honey. Based on SNI standard for maximum Pb minerals 2.0 mg/kg and maximum 0.2 mg Cd/kg. Thus it can be said that the mineral one of supporting a quality of honey.

In respect of these matters by digitally deemed necessary to conduct the research on the analysis of essential and non essential minerals in honey and test bio-chemical physics, in this study the minerals that will be analyzed is copper (Cu) is an essential mineral, lead (Pb) and cadmium (Cd) which is a non essential minerals. The mineral copper is very

ISSN 1411-2132
Volume 18 No. 1, 2017

important for human beings related to the formation of hemoglobin, and lack of substance is causing depletion of the body's endurance, and trigger the increase cholesterol levels, while cadmium and lead is a toxic polluters and heavy metals included in certain concentrations can impair human health.

The importance of this research because the quality of a honey greatly affect competitiveness in the global market. If you want to sign in to the industrial market, there needs to be an increase in the quality of honey to suit the desired industry standard or national requirements, including honey origin area of South Sulawesi, especially the area of the Bulukumba is one of the meperhatikan bee honey. This concern indicated in the regulatory area of the Regency Bulukumba number 21 (2012), which sets the Kindang Subdistrict as precinct area development honey cultivation. In the previous period have been set rules business license utilization of non timber forest products hereinafter referred to IUPHHBK given to manage non timber forest products like honey (Bulukumba Regency Government, 2008). Thus the mineral analysis of research in the area of Kindang is done in order to support the cultivation of honey.

2. METHODS

1. Sampling of Honey

Sampling performed in the forest honey Sub Kindang, District Bulukumba, Sulawesi Selatan, performed on three points, namely in the village of Kindang, Oro and Pattallossang. Samples have been taken next in place on the container that is free of contamination and stored in a *freezer* temperature of 4 – 5 ° C before it is analyzed.

2. Mineral Analysis Cu , Pb, and Cd on Honey

As many as 1 g of honey is put into the glass 50 mL Cup and then added 2 mL HNO_3 0.1 M above the bath, stirring frequently until almost gone. Then added again 10 mL HNO_3 0.1 M and stirred. After that, the sample solution included in 100 mL measuring flask and diluted with aquabides until the sign limits, further analyzed by ICP-OES.

3. Bio-Chemical Physical analysis of honey[2]

3.1 Moisture content

Some samples of honey melted on the surface of the Prism sample refraktometer and then closed. Temperature on refraktometer is set to reach a temperature of 20 ^oC. Then clear and dark zones searchable and set up to clear. Measurement of refractive index note.

Contents water in honey samples are assigned by comparing the value of the index is biased and water on the table relation refractive index (Attachment 2) . If the value of the refractive index is not found in the table, then set the standard calculation based on regression.

3.2 levels of Grey

Porcelain Cup drained in advance for 1 hour in the oven at a temperature of 150 ^{o} C, then cooled in the desiccator and then weigh. Samples weighed as much as 5 g and put it into a Cup. The sample incandescent above a *hot plate* until it's not smoky. Then put into the electric furnace at a temperature of 600 ^oC until a white ash is obtained. The sample is cooled in a desiccator and then weigh.

3.3 pH and Acidity

Prior to titration acidity, standardization of NaOH in advance done using $H_2C_2O_4$. In addition, the calibration of the pH meter is done using buffer pH 4, pH 9 and a pH of 14. Any before and after use pH-meter rinsed with aqua demineralizes.

Honey Samples weighed 5 g, and pH were measured using a pH-meter readings to remain for 10 seconds and pH on record. After that, dissolved with 35 mL non akuabides CO_2 and then onenter into an erlenmeyer flask 250 mL. Diadd 4-5 drops of indicator PP. Then d itit the constellation with a solution of NaOH 0.1 N to the point of final remains marked by a change of colour and pH 8.3 shows for 10 seconds. The volume of

ISSN 1411-2132
Volume 18 No. 1, 2017

NaOH 0.1 N used for titration note to calculate acidity of honey.

3.4 Electrical conductivity

As much as 1 0 gram samples of honey is dissolved with aqua de mineralized in 50 mL measuring flask and then assigned. As many as 20 mL of pipette and put into test tubes. Then the cell electrode is dipped in the sample test and set the temperature until it reaches 20 º C and the test results are recorded. Any before and after rinsing the electrodes with cells used aqua demineralisasi.

3.5 Levels of Protein

A total of 10 g of the sample in the and weigh in align in 50 mL measuring flask. Then 0.1 mL and pipette as much as align in a 100 mL measuring flask with akuades. Then a solution of BSA created as standard with a concentration of 0.02; 0.04 0.08 0.06;; and 0, 1mg/mL, and akuades as a solution of blanko. Each solution is put into different test tubes as much as 2 mL and coupled with a 2.75 mL reagent B Lowry, then beaten and silenced for 15 minutes. Then coupled with 0.2 3 mL solution of Lowry A, shuffled and silenced at room temperature for 30 minutes. Be measured its absorbance by spektronik 20 d +.

3.6 Fat levels

± 1 g of honey in the extraction with chloroform as many as 10 mL. Meanwhile, porcelain cup dried in an oven at a temperature of 110 ^{o}C for 1 hour. And then cooled in a desiccator and weigh its fixed weights. After that pipette as much as 5 mL sample and put it into a cup and then heated in an oven porcelain at a temperature of 105 ^{o}C for 4 hours and then cooled in a desiccator and then done weighing up to gained more weight anyway.

3.7 The determination of levels of Carbohydrates.

The formula used to determine the levels of carbohydrates are:

% Carbohydrate = [100 - content (protein + lipid + ash + water)] %.

3.8 Determination of calorie value

Value calories per 100 g sample:
Value calorie (kal) = (9 x % lipid) + (4 x % protein) + (4 x % carbohydrate) kal.

RESULTS AND DISCUSSION

1. Location Of Sampling

This research has been conducted on the analysis of essential minerals and nonesensial as well as bio-chemical physics test honey sourced from Sub Kindang Bulukumba Regency, South Sulawesi. As for s*ampling* was done on 25 may 2016 i.e. is forest honey with three samples at different points i.e. the village Kindang, Oro, and Pattallossang with an elevation of approximately 500-1000 m above sea level. Location map of the Sub-District of Kindang there are at Appendix 2.

2. Analysis of minerals (Cu, Pb, and Cd)

Mineral Cu, Pb and Cd is one of the determinant of the quality of honey. The third of these minerals belong to heavy metal which if found in honey with a concentration does not comply with the provisions, it will affect the quality of a honey. The third of these minerals is a heavy metal that can harm the health of the organism due to the toxic nature, yet essential minerals mineral Cu is indispensable in the formation of hemoglobin. While minerals Pb and Cd is the mineral nonesensial that do not give mamfaat thus may harm the organism.

This research using ICP-OES instruments because the tool is able to analyze almost all items at once in a short time and a high degree of accuracy. As for the results of a third test on the sample mineral honey Pattallossang (sample A), Oro (sample B), Kindang (sample C) shown in Figure 1.

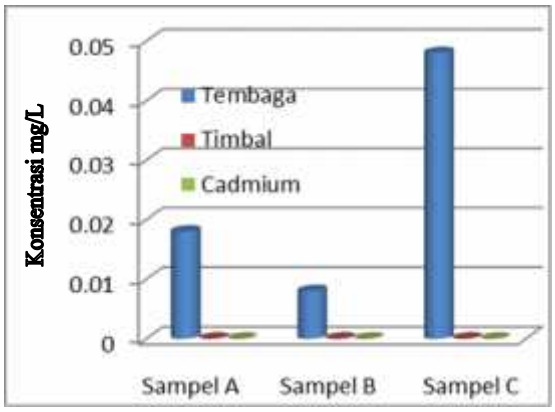


Figure 1. Mineral content of Cu, Pb, and Cd original honey samples Subdistrict Kindang

ISSN 1411-2132
Volume 18 No. 1, 2017

Based on Figure 1 Note that among these three minerals are the most dominant is the Cu, with A sample of 0.018 concentration in mg/L, the samples of B 0.008 mg/L, and sample C 0.048 mg/l. Pb and Cd Minerals not found on all three samples of honey indicates that a third of those honey samples free from polluters and according to SNI.

Copper is one of the much-needed mineral elements in the process of metabolism, the formation of hemoglobin and the physiological in the animal's body. Copper is a mineral elements grouped into micro essential elements. According to Bartik, et al (1989) though it takes in a little amount in the body, but when the excess can disrupt health, resulting in poisoning, but when a shortage of copper in the blood can lead to anemia which is a common symptom, the growth is compromised, the damage to the bones, depigmentation of the hair, wool or fur, feathers or abnormal growths of wool, gastrointestinal disorders. In addition to participating in the synthesis of hemoglobin, copper is also part of the enzymes within the cell, such as tyrosinase enzyme cofactors in the skin. In the liver, almost all copper bind to enzymes, especially enzymes that function as seruloplasmin feroksidase and transport in the blood (Sharma, et al., 2003). Some researchers report that copper atoms from seruloplasmin is incorporated in superoksid dismutase, a place cells receptor also identified

as seruloplasmin. After the merger of a number of copper in the liver, seen back in the bloodstream and are bound to albumin [4].

Variation of the concentration minerals in honey is affected by many factors, including: water, soil and flower nectar that is consumed by the bees. Mineral content that exists in nature honey will be hanging from the flower pollen that bees consumed and land for planting the flower pollen source. Geographical conditions also have an impact on mineral content in honey.

3. Bio-chemical physics Test honey

Analysis of bio-physics chemistry is the analysis based on some parameters of chemical and physical properties of biochemistry properties. Based on national standards which belongs to the physical properties of the chemicals contained in national standards number 01-3545-2013-honey and the international standards contained in the *International Honey Commission* (IHC) including acidity, pH, refractive index, electrical conductivity, the levels of ash and moisture content. Physical properties of chemical that madu is an important parameter in determining the quality of honey. Physical properties of chemical test results original honey Subdistrict Kindang are listed in table 3.

Table 3. Physical properties of chemical test results original honey Subdistrict Kindang

Sampel	Kadar Abu (%)	Keasaman (meq/kg)	Kadar Air	pH	Konduktifitas (mS/cm)
A	0,19	25,62	24,36	4,19	0,28
B	0,14	21,69	17,74	4,27	0,24
C	0,44	18,94	17,11	4,37	0,73
Min	0,14	18,94	17,11	4,19	0,24
Maks	0,44	25,62	24,36	4,37	0,73
Mean	0,25	21,96	19,73	4,27	0,46
IHC	≤1,2	≤50	≤25	≤3,6-5,6	≤0,8

3.1 analysis of levels of Grey

The grey levels is one of the aspects that are important in the determination of the physical chemistry of honey. In physics, the color of honey is influenced by levels of ash, the higher the level the more concentrated ash color honey. While chemically, grey levels indicate the correlation against the total concentration of minerals in honey. Based on data obtained the mean value of the average grey levels – honey origin Sub-district Kindang of 0.25% with the maximum value found in the sample C amounted to 0.44 and the minimum value is present on the sample B of 0.14%. Concentration levels of ash on the origin of the honey sub Kindang has met national standards based on table 2 i.e. maximum 0.5% and IHC in table 5 that is ≤ 1.2%.

3.2 Analysis of the pH and Acidity

Large number of free acid shows Acidity found in solution. Free acid in honey sourced from organic acids that many contained in honey like acetic acid and oxalic acid and the fraction of the minerals as Ca, K, Mg, and Na. Based on data obtained average value of acidity of honey origin Kecamatan

ISSN 1411-2132
Volume 18 No. 1, 2017

Kindang of 21.96 meq/kg with a maximum value of the sample at A value of 25.62 meq/kg. and the minimum value found in the sample C i.e. of 18.94 meq/kg. In accordance with the national standard acidity a honey is ≤ 50 meq/kg.

As for the relationship of acidity the pH value of a solution, i.e. the higher the acidity of honey then the smaller the pH of honey. In accordance with the data obtained shows the relationship between pH and acidity of honey origin Kindang, can be seen in Figure 2.

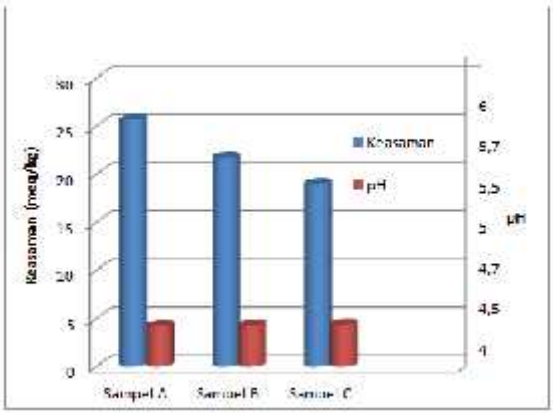
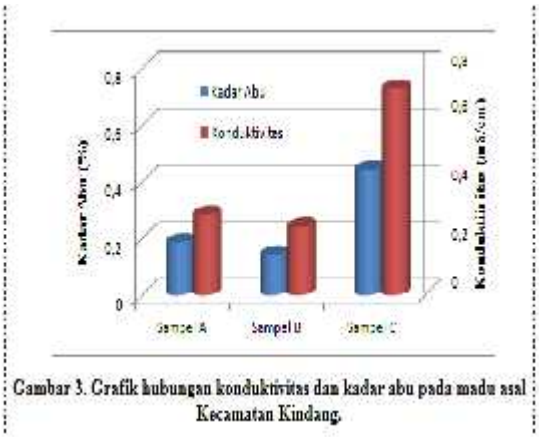


Figure 2. The relationship between pH and acidity of honey origin Subdistrict Kindang

In Figure 2 shows the median pH – Kindang is the origin of the honey averages 4.27 with a pH of minimum 4.19 in sample A and has the highest acidity and pH maximum 4.37 C on a sample with low acidity. According to Eleazu dkk., (2013) pH greatly affect the quality of a honey, low pH causing bacteria can't thrive . The Data shows that the pH of the origin of the honey Sub Kindang has been qualified the standard International honey i.e. pH 3.6 – 5.6.

3.3 Electrical Conductivity

Electrical conductivity is the ability of a material in delivers an electric current. Electrical conductivity (DHL) is associated with levels of ash, according a statement[2], which States that the increase in the levels of ash followed with increase in electrical conductivity in honey, the higher the levels of ash the higher electrical conductivity. On the origin of the honey Sub Kindang has the minimum sample contained in DHL B i.e. of 0.24 mS/cm and a maximum on a sample C i.e. of 0, 73 mS/cm conductivity levels relationship Graph ash shown in Figure 3.



Gambar 3. Grafik hubungan konduktivitas dan kadar abu pada madu asal Kecamatan Kindang.

In Figure 3 shows that the origin of the honey Sub Kindang conductivity increases along with the number of gray levels in honey. On the A sample has a conductivity i.e. 0.28 mS/cm with 0.18%, sample B i.e. 0.24 mS/cm with grey levels are 0.14%, whereas in sample C have conductivity i.e. 0.73 mS/cm with grey levels 0,44%.

3.4 Analysis Of Moisture Content

Moisture content greatly influences the quality of honey. The higher the moisture content in honey is fermented it will be easy. In accordance with the data obtained by mean of the mean moisture content – in the village of Kindang is 19.73% with the maximum value found in the samples with i.e. of 24.26% and minimum levels are present in the sample C i.e. of 17.11%. Water levels in the samples with very high, do not comply with national standards, namely 22% may be caused by rainfall the month of May is very high. Whereas the moisture content in sample C meets national standards, may be caused by geographical land. Moisture content in honey affect the durability of the honey. Low water levels are not easy with microbes for not easily fermented.

In addition to the physical parameters of the test chemical, biochemical test also was conducted regarding the content contained on the nutritional value of honey origin Subdistrict Kindang in the form of protein, fat and calories as this is a very macro-nutrient needed by the body. This analysis is important to know the composition of the major honey that can be used to draw up *nutrition fact* that are listed in the label packaging and beneficial

ISSN 1411-2132
Volume 18 No. 1, 2017

in the preparation of formula/food recipes especially for infants and for human beings who are in a time of healing.

3.5 Analysis of nutrition

In addition, the analysis of the nutritional value is also very useful in comparing the quality of similar commodities that could potentially be used as a food source of calories, especially honey. The results of the analysis of the origin of the honey nutrition Subdistrict Kindang are shown in table 4.

Table 4. The Results Of The Analysis Of The Origin Of The Honey Sub Nutrition Kindang

Kode sampel	Protein (%)	Karbohidrat (%)	Kalori (kal)	Lemak (%)
Sampel A	5,59	69,72	334,88	0,13
Sampel B	8,85	72,86	327,23	0,03
Sampel C	7,14	75,08	330,84	0,21

Protein is an essential food substances for the body. Because these substances in addition to serve as a fuel in the body also functions as a regulator of builders and substance. Protein is a source of amino acids containing the elements C, H, O and N which are not owned by fat or carbohydrates. Protein molecules containing sulfur and phosphorus, also there is a type of protein that contain elements of metals such as iron and copper [10].

Protein is a polypeptide comprising the amino acid bonding through the bonds of the amide. Proteins play a role helping the metabolic processes of the body and can also serve as antigens against bacterial diseases. The value of maximum protein contained in samples B i.e. 8.85%, the minimum value is set on A sample that is 5.56%. This is different from the value of copper minerals in honey that is maximum at sample C of 0, 048mg/L and a minimum at the sample B of 0 008mg/L, which indicates that the proteins in the sample C contains more minerals Cu. Difference in protein content in honey can be caused by the difference of the origin of nectar that is consumed by the bees. Based on protein content in honey origin Subdistrict Kindang indicates the honey samples is very beneficial for the health of the body.

Carbohydrates are organic compounds, one of which plays a major role in biomacromolecules bodies of living creatures. Carbohydrates serve as the main source of energy for living things. Carbohydrates are the largest component in honey can reach 85% primarily Monosaccharides (glucose and fructose) Fructose and glucose during digestion process can quickly be transported into the blood so fast also utilized the body as an energy source. Carbohydrate levels honey origin Subdistrict Kindang are 69.72% (sample A), 72.86% (sample B), 75.08% (sample C). Maximum levels are on A sample, and minimum levels in samples of C.

Based on table 4, note that the fat content of original honey Sub Kindang about 0.03 – 0.21%. Fat content of original honey Sub Kindang fat content is higher than original Regency Sinjai honey i.e. 0.01 – 0.05% [5]. Some foodstuffs in Indonesia can contain 10% or more of the ether extract (FAT), the influence of storage would cause Rancidity and can reduce the value of such materials.

The data content of carbohydrates, protein, and lipida can be used to calculate a calorie value food. The calorie value of honey very large i.e. 3,280 CAL/kg. The calorie value of 1 kg of honey is equivalent to 50 eggs chicken, 5.7 L milk, 1.68 kg meat, banana, fruit 25 40 citrus fruits, 4 kg potato (Kusuma, 2009). Honey has a high energy content in honey and sugar is digested in the body so young as commonly found in buah–buahan. The value of the original Sub-district honey calories Kindang of 334,8847-330,8494 CAL.

CONCLUSION

1. Conclusions

Based on the research that has been done on mineral analysis and test of bio-physics chemistry can be drawn the conclusion that the origin of the honey Sub Kindang Bulukumba Regency is a quality honey in accordance with SNI and IHC. Copper minerals concentration was 0, 024mg/L while the lead and cadmium was not detected by the value parameter test bio-chemical physics is honey; the rate of 0.25% ash; 19,73% moisture content; DHL 0, 46mS/cm; the acidity of 21, 96meq/kg; pH 4.27; protein 7.19%; fat 0.2481%; 72,55% carbohydrates.

ISSN 1411-2132
Volume 18 No. 1, 2017

2. Suggestions

On research next time *sampling* needs to pay attention to environmental conditions and other botanical factors and add the parameter analysis of microbial impurities, such as enzymes.

REFERENCES

[1] Anonim, 2012, *Peraturan Daerah Kabupaten Bulukumba No. 21*, Bulukumba.

[2] Bogdanov, S., 2009, *Harmonised Methods of the International Honey Comissions*, World Network of Honey Science, Switzerland.

[3] Conti, M.E., 2000, Lazio region (central Italy) honeys: A survey of mineral content and typical quality parameters, *J. Food Contr.*, **11**; 459–463.

[4] Darmono. 1995. *Logam dalam Biologi Makhluk Hidup*. Penerbit Universitas Indonesia Press. Jakarta.

[5] Karim, F.F., Noor, A., dan Natsir, H., 2015, *Analisis Mineral Esensial (Vanadium, Kobalt dan Nikel) dan Uji Bio-Fisika Kimia pada Madu asal Desa Terasa Sinjai*, Jurusan Kimia FMIPA Universitas Hasanuddin, Makassar.

[6] McDonald, P., Edwards, R.A., and Greenhalgh, J.F.D., 1988, *Animal Nutrition,* John Willey and Sons Inc., New York.

[7] Murtidjo, B. A. , 1991, Memelihara Lebah Madu, Kanisius, Yogyakarta

[8] Purbaya, J. R. ,2002, Mengenal dan Memanfaatkan Khasiat Madu Alami,Pionir Jaya, Bandung.

[9] Vanhanen, L.P., Emmertz, A., and Savage, G.P., 2011, Savage Mineral Analysis of Mono-floral New Zealand Honey, *Food Chem.*, **128**; 236–240.

[10] Winarno, F.G., 1982, *Madu, Teknologi, Khasiat dan Analisis*, Ghalia Indonesia, Jakarta.